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# *Les Observatoires astronomiques en Italie* An 1863 report by Otto Wilhelm Struve

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## **Abstract**

In the autumn of 1863 Otto Wilhelm Struve, director of the Pulkovo Astronomical Observatory in Russia, visited most of the observatories in Italy. The report that he wrote on this occasion provides an overview on the conditions of astronomical research in Italy just after the unification of the country. Later Struve sent a French translation of his report to the Italian astronomer Giovan Battista Donati, who used it to promote the construction of the Arcetri Observatory in Florence, which was inaugurated in 1872. We present here a transcription of the French translation of Struve’s report and the transcription of a letter written by him in support of Donati’s project.

## **Keywords**

Otto Wilhelm Struve, Giovan Battista Donati, Italian observatories, Arcetri

## **1. Introduction**

During the second half of the nineteenth century, one of the most influential scientists in the field of classical positional astronomy was the German-Russian Otto Wilhelm Struve (1819-1905). His authority stemmed primarily from his scientific achievements, which included a survey of double stars in the northern hemisphere leading to the discovery of more than 500 new pairs, and the determination of the constant of precession and the direction of solar motion, for which he was awarded the Gold Medal of the Royal Astronomical Society in 1850. However, a good part of Otto Struve’s reputation also undoubtedly derived from his being the son of the celebrated Friedrich Georg Wilhelm Struve (1793-1864), who himself had discovered many double stars and was one of the first astronomers to measure a stellar parallax, that of  $\alpha$  Lyrae in 1837.<sup>1</sup>

Wilhelm Struve’s legacy to his son included a methodology for determining stellar positions with the careful control of systematic and random errors<sup>2</sup> and the directorship of the observatory of Pulkovo near St. Petersburg. This research institute

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<sup>1</sup> For biographies of the two astronomers, see Alan H. Batten, *Resolute and Undertaking Characters: The Lives of Wilhelm and Otto Struve* (Boston: D. Reidel Pub. Co., 1988).

<sup>2</sup> The “Struve method” is described in Kevin Krisciunas, “Pulkovo Observatory’s status in 19<sup>th</sup>-century positional astronomy,” in *Inertial Coordinate System on the Sky*, International Astronomical Union Symposia, 141:15-24, edited by Jay H. Lieske, Viktor K. Abalakin (Dordrecht: Kluwer Academic Publishers, 1990), p. 16.

was founded by Wilhelm in 1839 under the patronage of Tsar Nicholas I (1796-1855) and was directed by him until 1862, when he was succeeded by his son. With its extensive array of state-of-the-art instruments installed in a grandiose, purpose-built edifice, the Pulkovo Observatory earned an international reputation and many astronomers visited it or spent a period of time working there. Pulkovo was dubbed “the astronomical capital of the world”<sup>3</sup> and its observatory was described by the Italian Giovan Battista Donati (1826-1873) as “a truly and splendid scientific royal palace of which he [Otto] is the prince.”<sup>4</sup>

Thus, the opinion of Otto Struve on astronomical matters would have been considered valuable by many astronomers. We show that such was the case for a report on Italian observatories written by Struve after a scientific tour of the peninsula in 1863. Besides offering modern historians an external expert’s view on the conditions of astronomical research in Italy just after unification, the report was used at the time by Donati to promote his own project for the construction of a new astronomical observatory at Arcetri near Florence.

The full account of Struve’s 1863 trip, including his report on Italian observatories, was published the following year,<sup>5</sup> but because it was written in Russian its diffusion in Europe would have been limited.<sup>6</sup> In response to a request – made by Donati, as we will argue below – in 1867 Struve had a French translation prepared of the section of the report pertaining to Italian observatories. The original manuscript of the French version is conserved among the Struve–Donati correspondence at the St. Petersburg branch of the Archive of the Russian Academy of Science. We present a transcription of this manuscript in Appendix 1 and the draft of a letter written by Struve to Donati on October 22, 1871 in support of the Arcetri Observatory (which is conserved in the same archive) in Appendix 2.

## 2. A reconstruction of Struve’s 1863 voyage

Otto W. Struve suffered from bad health, particularly during the first years of his directorship of Pulkovo Observatory.<sup>7</sup> Because of this he often visited resorts and spas in the more moderate climes of Europe, where he could recover from the rigors of the Russian winter and from the exertions of his work. The trip in 1863 was originally planned as a much-needed holiday after a period of intense activity, but it acquired a scientific purpose when the Minister of Public Education, Alexander Golovnin (1821-1886), asked him to visit the observatory of the English astronomer William Lassell

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<sup>3</sup> Batten, *Resolute and Undertaking Characters* (cit. note 1), pp. 89-112.

<sup>4</sup> “[...] una vera e splendida reggia scientifica, ov’egli sta principe.” Giovan Battista Donati, *Parole pronunziate dal Prof. G.-B. Donati per la solenne inaugurazione del nuovo osservatorio di Firenze ad Arcetri il di 27 ottobre 1872* (Firenze: Le Monnier, 1872).

<sup>5</sup> Otto Struve, “Otchet o zagranichnom puteshestvii direktora Nikolaevskey glavnoy observatorii,” *Zhurnal Ministerstva narodnogo prosveshcheniya*, 1864, 122:177-197.

<sup>6</sup> Struve’s report was recently re-published in Russian, together with the collected correspondence between Otto Struve and Giovanni Virginio Schiaparelli, in Viktor K. Abalakin (ed.), *O.V. Struve–Dzh.V. Skiaparelli: perepiska 1859-1904* (St. Petersburg: Nauka, 2005).

<sup>7</sup> For instance, due to poor health Struve spent the winter of 1864-1865 on leave in Italy. See Batten, *Resolute and Undertaking Characters* (cit. note 1), p. 169.

(1799-1880) on the island of Malta.<sup>8</sup> The voyage gave Struve the opportunity to participate in the founding conference of the Astronomische Gesellschaft in Heidelberg<sup>9</sup> and to visit astronomical observatories with which he wished to establish scientific relations on his way to and from Malta.<sup>10</sup>

Struve left Pulkovo on August 22, 1863 and reached Heidelberg on August 27, the first day of the conference.<sup>11</sup> After the three-day meeting he travelled to Karlsruhe and later to northern Italy, where he spent a week on the shores of Lake Como and a further week in Milan.<sup>12</sup> He then boarded a ship in Genoa bound for Palermo, and from there reached Malta, where he stayed from October 7 to 11.<sup>13</sup> By mid-October he was back on the peninsula, stopping in Naples<sup>14</sup> before travelling north, stopping in

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<sup>8</sup> The aim of this stop on his trip was to test the performance of Lassell's 120-cm reflector under the ideal climatic conditions of Malta, comparing it with the 38-cm Merz & Mahler refractor in Pulkovo. A full report was presented to the Imperial Academy of Sciences of St. Petersburg and published in Otto Struve, "Über das von Herr W. Lassell in Malta aufgestellte Spiegelteleskop," *Mélanges Mathématiques et Astronomiques*, 1866, 3:517-550. Struve presented a summary of his conclusions in "Otchet" (cit. note 5), pp. 181-187. For a modern account of the astronomer's visit in the context of the dispute between the users of refractors and reflectors, see Wolfgang Steinicke, *Observing and Cataloguing Nebulae and Star Clusters: From Herschel to Dreyer* (Cambridge: Cambridge University Press, 2010), pp. 213-216.

<sup>9</sup> The Heidelberg congress took place between August 27 and 29, 1863; see Wilhelm Seggenwiss, "Die Versammlungen der Astronomischen Gesellschaft 1863-1981," *Mitglieder der Astronomischen Gesellschaft*, 1982, 57:135-142. Twenty-six astronomers took part and on August 28 they founded the Astronomische Gesellschaft, whose scope was to coordinate international collaborative studies; see Klaus H. Tiemann, "The founding meeting of the Astronomical Society on August 28, 1863 and its members," *Astronomische Gesellschaft Abstract Series*, 1990, 4:82. Struve was an advisory member on the first committee; Struve, "Otchet" (cit. note 5), pp. 177-179.

<sup>10</sup> The scientific and personal objectives of the 1863 voyage are reported in Struve, "Otchet" (cit. note 5), p. 177 and in Struve, "Über das von Herr W. Lassell Spiegelteleskop" (cit. note 8), pp. 517-518. A further account is given in Otto Struve, "Wissenschaftliche Reisen," *Jahresbericht am 17. Mai 1864 dem Comite der Nicolai Hauptsternwarte, abgestattet von Director der Sternwarte* (St. Petersburg: Buchdruckerei der Kaiserlichen Akademie der Wissenschaften, 1864), pp. 18-20.

<sup>11</sup> The two dates are given in "Otchet" as August 10 and 15, i.e. following the Julian calendar in use at the time in the Russian Empire. Struve, "Otchet" (cit. note 5), p. 177. In the 19<sup>th</sup> century the difference between the Julian and Gregorian calendars amounted to 12 days.

<sup>12</sup> These details can be found in a letter written by Schiaparelli to A. Secchi S. J. on October 5, 1863: "[...] Otto Struve [...] verso la metà di ottobre [...] sarà in Roma [...]. Egli è stato una settimana sul lago di Como, ed un'altra in Milano; poi è partito per Malta [...]. Ritornando da Malta egli si propone di fare [...] il giro delle principali città d'Italia, e dei suoi osservatorii" (Otto Struve will be in Rome by mid-October. He spent a week on the lake of Como and another in Milan; then he left for Malta. Coming back from Malta he intends to make a tour of the main Italian cities and their observatories). In Letizia Buffoni, Alessandro Manara, Pasquale Tucci (eds.), *G.V. Schiaparelli, A. Secchi corrispondenza (1861-1878)* (Milano: Artes, 1991), p. 29.

<sup>13</sup> These dates are reported as they appear in "Otchet" (cit. note 5), p. 184. They are probably based on the Gregorian calendar, because if the Julian calendar had been used they would be inconsistent with the Italian sources.

<sup>14</sup> Struve complained of the cool reception he was given by the astronomers at the Capodimonte Observatory in Naples, a fact that is commented on by Schiaparelli in a letter a few days later. Schiaparelli to Struve, Milan, 17/10/1863, in Abalakin, *Struve-Schiaparelli*:

Rome, Florence and Bologna. On October 27 he left Bologna, reaching Modena on the same day and Turin, at the time the capital of the Kingdom of Italy, on the following day.<sup>15</sup> On October 30 Struve was in Milan once again, and from there he travelled to Padua.<sup>16</sup> On the way back from Italy to Russia, Struve visited the observatories of Vienna and Leipzig.<sup>17</sup> By the end of November he was probably home again in Pulkovo, where he completed his report on December 12.<sup>18</sup>

### 3. The report on Italian observatories

Struve visited a total of ten observatories in Italy, almost all of which were public institutions. Seven belonged to the recently declared Kingdom of Italy – the observatories in Brera, Turin, Modena, Bologna, Florence, Capodimonte, and Palermo.<sup>19</sup> The two in Rome belonged to the Papal States; the Campidoglio Observatory was attached to the University of Rome, while the observatory of the Collegio Romano belonged to the Jesuits. The observatory in Padua was attached to Padua's university, and Padua at the time formed part of the Kingdom of Lombardy–Venetia, which belonged to the Austrian Empire.<sup>20</sup>

The sheer number of observatories – as Struve argued in the initial part of his report – was not indicative of a flourishing state of research in Italy. On the contrary

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*perepiska* (cit. note 6), p. 11. Thus, Struve had *already* visited Naples on October 17. This is consistent with the visit to Malta having ended on October 11 of the Gregorian calendar.

<sup>15</sup> These details of the trip from Bologna to Turin are to be found in a telegram sent by O. Struve to G.V. Schiaparelli in Bologna on October 27 1863 (Archive of the Astronomical Observatory of Monte Porzio, correspondence of Lorenzo Respighi, Folder 5). In the telegram Struve asks Schiaparelli to meet him in Turin.

<sup>16</sup> “Otto Struve è partito la mattina dello scorso venerdì per Padova e per Vienna, e conta di trovarsi a Pietroburgo per la metà del mese corrente” (Otto Struve left for Padua on last Friday morning [October 30], and hopes to be in St. Petersburg by the middle of the current month). Schiaparelli to Secchi, Milan, 2/11/1863, in Buffoni, Manara, Tucci, *Schiaparelli, Secchi corrispondenza* (cit. note 12), p. 29. In fact, Struve reached Padua on October 30, visited the observatory, and on the same day sent a card to the director, Santini, thanking him for his courteous reception. Giampiero Bozzolato, Piero Del Negro, Cecilia Ghetti, *La Specola dell'Università di Padova* (Brugine: Edizioni 1+1, 1986), p. 358.

<sup>17</sup> Struve, “Wissenschaftliche Reisen” (cit. note 10), p. 19.

<sup>18</sup> November 30, Julian calendar. Struve, “Otchet” (cit. note 5), p. 197. Struve finished writing the “Otchet” a few days after his report on Lassell's telescope, which is dated using both calendars, November 27/December 9. Struve, “Über das von Herr W. Lassell Spiegelteleskop” (cit. note 8), p. 517.

<sup>19</sup> Among the state-run observatories, the only one that Struve did not visit was the observatory in Parma.

<sup>20</sup> Other European astronomers have left reports of their visits to Italian observatories. In 1840 Karl Ludwig Littrow (1811-1877) made a tour that included some of the institutes seen by Struve (in Padua, Bologna, Florence, Rome and Capodimonte): “Astronomia. Stato della scienza in Italia,” *Gazzetta privilegiata di Milano*, 1840, N. 225-226 (August 12 and 13). In 1858 Nicolas-Édouard Mailly (1810-1891) published a report on the observatories of Palermo, Capodimonte and Rome: *Relation d'un voyage fait en Sicile et dans le Midi de l'Italie, pendant les mois de mai et de juin 1858* (Bruxelles: Hayez, 1859). In 1875 Georges Rayet toured Italy and visited the same observatories as Struve, afterwards publishing a detailed account of their history, facilities, and research work: *L'astronomie pratique et les observatoires en Europe et en Amérique, depuis le milieu du XVIIe siècle jusqu'à nos jours. cinquième partie: observatoires d'Italie* (Paris: Gauthier-Villars, 1878).

astronomy was in a condition of “*décadence parfaite*” and the many institutions were the result of the fragmented nature of the country before unification, as of 1863 not yet fully completed. The observatories had been created out of a “*désir indéterminé*” to contribute to the development of astronomy, without however there being a coherent research program.<sup>21</sup> When they were established (most of them in the 18<sup>th</sup> century), the observatories were equipped with state-of-the-art instruments, but limited budgets made it difficult for each pre-unitarian state to fund its own fully active institute, to keep its facilities up to date, or to support the formation of a strong school of astronomy. This fragmentation had a similar effect on all branches of science and technology, causing Italy to lag behind other European countries. However, Struve believed that the situation was improving under the new political order, as it was shown by the recent burst of activity in Italian Observatories.

The major problem of most Italian observatories was that they were installed on top of high buildings in busy city centres. They were therefore built on unstable foundations subject to the vibration caused by human activities, which made the accurate measurement of stellar positions extremely difficult. The only exception was the Observatory of Capodimonte, which was built in the 1820s on a hill outside of Naples directly onto solid rock. However, not even the building or facilities of this observatory, according to Struve, satisfied the criteria of modern astronomy.

After opening with some general comments on the state of astronomy in Italy, Struve goes on to describe the individual observatories. In most cases he provided some historical background and a description of the building, its instrumentation, and the scientific work that was being conducted there.<sup>22</sup> He did not follow a uniform format; the space dedicated to a given observatory seems to have reflected its importance, the length of time Struve spent there, and last but not least the affinity he felt for the colleagues whom he encountered and their work. Mutual sympathies sprang up that appear in some cases to have mitigated Struve’s appraisal, making it less severe than for that of Italian astronomy as a whole.

His account of the Palermo Observatory was particularly benign; as he admits, he felt “*sentiments [...] de veneration*” towards the founder of the observatory, Giuseppe Piazzi (1746-1826). The extremely accurate measurements of stellar positions in Piazzi’s celebrated catalogues bridged the gap between the earlier observations of James Bradley (1693-1762) and more recent research, extending the timeline for the study of the apparent and real motion of the stars which was the primary focus of research in Pulkovo. It is therefore not surprising that the report on Palermo is the longest of the ten, taking up a full quarter of the text dedicated to Italian observatories. Although in his introduction Struve stated that the only suitably housed observatory was that of Capodimonte, he praised the solidity of the Palermo

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<sup>21</sup> This lack of coordinated planning contrasted with the sovereign statute of Pulkovo Observatory, which states that one of the objectives of the institute was “*de fournir des observations suivies et aussi parfaites que possible, tendant à perfectionner l’Astronomie comme science.*” Wilhelm Struve, *Description de l’observatoire astronomique central de Poulkova* (St. Petersburg: Académie Impériale des Sciences, 1845), p. 57.

<sup>22</sup> For a general overview of the state of Italian astronomy in the second half of the 19<sup>th</sup> century, see: Fabrizio Bònoli, Giorgia Foderà Serio, Francesco Poppi, “La ricerca astronomica in Italia al momento dell’unità: uomini e strutture,” in *Cento anni di Astronomia in Italia*, Atti dei convegni Lincei 217 (Roma: Bardi, 2005) pp. 29-72; and Luisa Pigatto, “Gli Osservatori Astronomici nell’Italia unita,” *Giornale di Astronomia*, 2012, 38:2-11. Both of these studies include extensive bibliographies on the origins and history of each observatory.

observatory's foundations (describing, for example, the "épaisseur énorme" of the high tower in which the telescope was placed – the *Torre di S. Ninfa* of the *Palazzo dei Normanni*, referred to by him as the "palais royal") and its position well to the south of the city centre (facing a quiet square and surrounded by a garden, it was well shielded from vibrations). Given these favourable conditions, Struve concluded that the observatory in Palermo was the only one with the potential to make a serious contribution to modern astronomy.

Struve also commented positively on the location of the observatory of the Collegio Romano; its instruments were mounted on two of the four enormous pillars that had been constructed to support a dome for the church of S. Ignazio, which was never completed. Despite their height these pillars were surrounded by the other buildings of the Collegio, which shielded the instruments from variations in temperature due to solar heating-

In contrast it is not clear why in the end Struve harboured reservations about the construction of the Capodimonte Observatory, as the only criticism he expressed concerned one of its domes. Instead, the buildings of the other Italian observatories were deemed outright to be inadequate. In the case of Brera, for example, Struve recommended that a completely new observatory be built on the outskirts of the city.

In his comments on the equipment that he found, Otto Struve compared the instruments in two Italian institutes with those being used forty years earlier by his father Wilhelm at the observatory in Dorpat – a refractor by Fraunhofer with a 24-cm aperture (equivalent to 9 French inches) and a Reichenbach & Ertel meridian circle with a graduated scale of 97 cm (3 feet) in diameter (the larger the diameter of the circle, the greater the accuracy in the measurement of declinations).<sup>23</sup> Although Struve's intention was simply to provide an objective appraisal, his report showed how obsolete much of the equipment in Italian observatories was.<sup>24</sup> Indeed, even the instruments in Dorpat could be considered out of date as they were surpassed by those in the Pulkovo Observatory, which was inaugurated in 1839: a 38-cm refractor by Merz & Mahler (the successors to Fraunhofer); a 110-cm vertical circle by Ertel & Sohn; and a 120-cm meridian circle by Repsold.<sup>25</sup>

Only three of the telescopes in Italy matched the standards of the Dorpat refractor and all three were made by Merz: a telescope with a 22-cm aperture that had just been ordered for the Brera Observatory and was under construction in Munich; a telescope with a 24-cm aperture already in use for 10 years at the observatory of the Collegio Romano; and finally a new 24-cm refractor waiting to be unpacked and installed at the Palermo Observatory.<sup>26</sup> The Florence Observatory boasted the largest

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<sup>23</sup> Wilhelm Struve, *Observationes Astronomicas Institutas in Specula Universitatis Caesareae Dorpatensis, Observationes annorum 1822 et 1823* (Dorpat: Schuenmann, 1825), pp. ii-iv.

<sup>24</sup> A list the types of instruments being used in Italy in the 19<sup>th</sup> century is provided by Bònoli et al., "La ricerca astronomica in Italia" (cit. note 22). An inventory of the instrumentation actually to be found in the observatories of the Italian Kingdom (with the exception of Parma) in 1864 was published in: "Principali strumenti di astronomia posseduti dagli osservatori del Regno," *Annuario della istruzione pubblica del Regno d'Italia pel 1863-64* (Brescia: Tipografia del giornale La Sentinella Bresciana, 1864), pp. 617-625. We refer to those works for details on the instrumentation.

<sup>25</sup> Struve, *Description de Poulkova* (cit. note 21), pp. 130-167, 181-205.

<sup>26</sup> The fact that the observatories in Palermo and at the Collegio Romano were equipped with the same refractors led to the collaboration between Pietro Tacchini and Angelo Secchi, and eventually to the formation in 1871 of the *Società degli Spettroscopisti Italiani*. Its journal,

refractor in Italy, a telescope with a 28-cm aperture that had been made by its former director, Giovan Battista Amici (1786-1863).<sup>27</sup> Struve could not comment on its performance as the tube still lacked its equatorial mount, but a parliamentary bill to finance its construction was about to be presented.<sup>28</sup>

Most of the Italian observatories had serviceable, if out-of-date meridian circles, some of which could still make a useful contribution to astronomy according to Struve if they were set up properly. Both Modena and Turin had Reichenbach & Ertel instruments equivalent to the one in Dorpat,<sup>29</sup> while Milan and Padova were equipped with copies made by Stark in Vienna. More up-to-date instruments by Ertel & Sohn, although with smaller, 2-foot (65 cm) circles were being used in Bologna and at both of the observatories in Rome. The finest instrument was probably the 3-foot Pistor & Martins circle installed in Palermo in 1856; in Struve's view this, together with the Merz refractor, made the Palermo Observatory the best-equipped in Italy.

In his report Struve wrote that the state of the equipment at the Capodimonte observatory was the most disappointing, as it belied the promise of the optimal site and construction of the observatory itself. In fact, the instruments were all early products of the Reichenbach and Fraunhofer ateliers, dating to the first half of the 1810s when construction of the observatory had just begun. From the fact that he found so many early versions of Reichenbach instruments in Italian observatories, Struve inferred that there had been an explosion of interest in astronomy just after the Restoration, inspired by Piazzi's work at the beginning of the century.

In the light of their poor working conditions, Struve appreciated all the more the research being done by some of his Italian colleagues. Giovan Battista Donati, director of the observatory in Florence, and Giovanni Virginio Schiaparelli (1835-1910), who spent a period at the observatory in Pulkovo (1859-1860) before becoming director of the Brera Observatory in 1863, are praised for running their institutes effectively and achieving impressive results with the poor means at their hands. Angelo Secchi S.J. (1818-1878) is cited for the "esprit éminent scientifique" that characterized the Collegio Romano Observatory under his direction, while Giovanni Santini (1787-1877), the director of the observatory in Padua, surprised Struve with his unflagging enthusiasm despite his great age.

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*Memorie*, became the first journal dedicated to astrophysics; see Ileana Chinnici, "The 'Società degli Spettroscopisti Italiani': birth and evolution," *Annals of Science*, 2008, 65:393-438.

<sup>27</sup> Alberto Meschiari, Simone Bianchi, "The legacy of Giovanni Battista Amici at Arcetri on the 150<sup>th</sup> anniversary of his death," *Il Colle di Galileo*, 2013, 2:9-25.

<sup>28</sup> Struve was probably referring to this bill when he said that the telescope "est maintenant acquis pour l'Observatoire de Florence." In point of fact the telescope was already the property of the observatory. The parliamentary bill drafted to finance the construction of the telescope mount and the observatory's dome was presented to the House of Deputies on November 23, 1863 and passed into law on February 21, 1864; see Simone Bianchi, Daniele Galli, Antonella Gasperini, "'The first Astronomical Observatory of Italy.' The birth of the Arcetri Observatory (1861-1873)," *Il Colle di Galileo*, 2012, 1-2:55-70.

<sup>29</sup> Struve only notes that the instrumentation in Turin was similar to that of the observatory in Modena.

Among the scientific works of Italian astronomers, Struve mentioned the star catalogues compiled in Brera<sup>30</sup> and Padova,<sup>31</sup> and the measurements of double stars carried out at the Collegio Romano.<sup>32</sup> Considerable space is dedicated to the measurements of the zenith distance of the star  $\alpha$  Cygni as a way of determining the latitude of Bologna Observatory.<sup>33</sup> The expedients resorted to by its director Lorenzo Respighi (1824-1889) betray the inadequacies of the institute's meridian circle and its installation. Being absolute measurements of little accuracy, the astronomer put a mercury vessel in a pit under the instrument and used its telescope directed at nadir; the zenith distance was obtained measuring with a micrometer the angle between the reflections of the star and of a wire in the illuminated reticle (the latter indicating the vertical direction). Struve furthermore gives Respighi credit for his discoveries of comets. Annibale de Gasparis (1819-1892), the second astronomer at Capodimonte,<sup>34</sup> is cited for his observation of many new asteroids – according to Struve the only research that could be conducted at the observatory given the obsolescence of its instruments.<sup>35</sup>

The Russian astronomer's judgement of other observatories was much harsher. The Campidoglio Observatory was used, according to him, only when the fancy took its director, Ignazio Calandrelli (1792-1866), to amuse himself by stargazing. Despite the fact that the observatory in Modena had a most qualified director, before the unification of Italy, in the learned Giuseppe Bianchi (1791-1866), the institute had never produced any results worth mentioning. The Turin Observatory was dismissed as “parfaitement inutile à la science” because its director, Giovanni

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<sup>30</sup> Giovanni Virginio Schiaparelli, Giovanni Celoria, “Posizioni medie per 1870,0 di 1119 stelle fino alla grandezza 7m,5, comprese fra -2 e +6 di declinazione, determinate con osservazioni fatte al circolo meridiano di Starke negli anni 1860-1872,” *Pubblicazioni del Reale Osservatorio astronomico di Brera*, 1901, 41.

<sup>31</sup> Giovanni Santini, *Posizioni medie di 2246 stelle distribuite nella zona compresa fra li 12° 30' e li 15° di declinazione australe dedotte dalle osservazioni fatte dal sig. Trettenero nell'I.R. Osservatorio di Padova negli anni 1857-58-59-60-61* (Venezia: Segreteria dell'I.R. Istituto, 1862).

<sup>32</sup> Angelo Secchi, *Catalogo di 1321 stelle doppie misurate col grande equatoriale di Merz all'Osservatorio del Collegio Romano e confrontate colle misure anteriori* (Roma: Tipografia delle belle arti, 1860).

<sup>33</sup> Lorenzo Respighi, “Sulle osservazioni circumzenitali delle stelle,” *Memorie dell'Accademia delle scienze dell'Istituto di Bologna, Serie II*, 1862, 2:201-223; “Sulla latitudine geografica dell'Osservatorio di Bologna,” *ibid.*: 397-436.

<sup>34</sup> Annibale de Gasparis probably served as Struve's guide during his visit, because he is mentioned more often than the director, Ernesto Capocci (1798-1864). In fact, Capocci was seriously ill and in October left Capodimonte for his hometown, where he died on January 6, 1864. Francesco Del Giudice, “De' lavori accademici nell'anno 1864,” *Atti del R. Istituto d'Incoraggiamento alle Scienze Naturali Economiche e Tecnologiche di Napoli, Serie 2*, 1865, 2:25.

<sup>35</sup> Struve wrote that de Gasparis was planning to publish a star chart to be used in the search of asteroids. However, Struve's description corresponds to the Hora XVIII drawn up by Capocci in 1828 and published by the Königlich Akademie der Wissenschaften of Berlin as one of its akademische Sternkarten. *Akademische Sternkarten für den Gürtel des Himmels von 15° südlicher bis 15° nördlicher Abweichung nach Bessel's Vorschlag entworfen von verschiedenen Astronomen* (Berlin: Königlich Akademie der Wissenschaften, 1859). It may be hypothesized that there was a misunderstanding on Struve's part or else that the publication of a reprint in Italy of the map and catalog was planned but never realized.

Plana (1781-1864), who was famous for his studies of celestial mechanics, appeared to despise all research that had anything to do with practical astronomy.

In this context as well, Struve appeared to make an exception for the Palermo Observatory. Its director, Gaetano Cacciatore (1814-1889), was ousted from his post for more than a decade due to his political views and had had little opportunity to remain abreast of new developments in the field. When he was reinstated as director after the country's unification, Cacciatore confessed this shortcoming to Struve, who sought to encourage him by proposing two research projects that were of great interest to himself.

The inspiration for the first project stemmed from the fact that the instrument used by Piazzi to compile his stellar catalogue – the famous Ramsden vertical circle – was still in place and in much the same configuration as that used for his observations. Since it was recognized (among others, by Otto's father Wilhelm) that Piazzi's measurements were flawed by a series of systematic errors, Struve proposed that this source of uncertainty be removed either by analysing the optics and mechanics of the instrument itself or by conducting simultaneous observations using the Ramsden circle and a modern instrument. For this purpose he offered to place at Cacciatore's disposition one of his instruments in Pulkovo.<sup>36</sup> The second proposal was to extend the Pulkovo double star survey<sup>37</sup> to declinations down to  $\delta = -30^\circ$ . Cacciatore apparently agreed to undertake these projects together with his new assistant, Pietro Tacchini (1838-1905), who assumed his post in Palermo just after Struve's visit. In fact, Tacchini rather than Cacciatore would prove to be the moving spirit behind the scientific activities of the institute. Perhaps Struve realized this for he had met Tacchini before and had full confidence in his abilities. In the end, however, neither of his two projects was realized.

Struve's report also described the first forays of Italian scientists into the fields of physical astronomy and astrophysics. Studies of the physical characteristics of the sun conducted at the Collegio Romano were documented in a series of drawings of sunspots.<sup>38</sup> At the Florence Observatory Donati used an old Herschel 22-cm reflecting telescope<sup>39</sup> to take pictures of our star, although these studies were not conducted systematically.<sup>40</sup> Donati is also cited for his pioneering work on stellar spectra<sup>41</sup>

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<sup>36</sup> Piazzi's observations were revised by Francesco Porro (1861-1937), at first with the help of Gustav Ludwig Struve, the son of Otto. See Edoardo Proverbio, "The third reduction of Giuseppe Piazzi's star catalogue," in *Mapping the Sky: Past Heritage and Future Directions*, International Astronomical Union Symposia, 133:75-86, edited by Suzanne Debarbat (Dordrecht: Kluwer Academic Publishers, 1988). Struve's proposal to revise Piazzi's catalog reflected his plan to carry out a further analysis of Bradley's observations, as discussed at the 1863 Heidelberg conference; Struve, "Otchet" (cit. note 5) pp. 178-179; Struve, "Wissenschaftliche Reisen" (cit. note 10).

<sup>37</sup> Wilhelm Struve, *Catalogue de 514 étoiles doubles et multiples découvertes sur l'hémisphère céleste boréal par la grande lunette de l'Observatoire central de Poulkova et Catalogue de 256 étoiles doubles principales ou la distance des composantes est de 32 secondes à 2 minutes et qui se trouvent sur l'hémisphère boréal* (St.-Petersbourg: Impr. de l'Académie impériale des sciences, 1843).

<sup>38</sup> Angelo Secchi, "Ricerche fisiche intorno ai corpi celesti. IV. Osservazioni delle macchie solari dal 17 dicembre 1858 al 31 luglio 1859," *Memorie dell'Osservatorio del Collegio Romano*, 1859, 4:25-32.

<sup>39</sup> This is the only reflecting telescope mentioned in the report.

<sup>40</sup> Donati's attempts to photograph the sun date as far back as 1856; see Daniele Galli, Antonella Gasperini, Simone Bianchi, "Dalla meccanica celeste alla spettroscopia stellare.

carried out using a 17<sup>th</sup>-century burning lens to collect light. In contrast, no mention is made of the spectroscopic studies conducted in 1863 by Secchi<sup>42</sup> which eventually led to his system of classifying stellar spectra (unless this was implied in Struve's generic reference to "recherches de physique").

In his discussion of the Brera Observatory, Struve touched briefly on another problem in Italian astronomy – the shortage of personnel and their low salaries. The staff at Brera was officially composed of a director and four assistants,<sup>43</sup> but one of the latter positions was kept vacant in order to save money for other items in the observatory's budget. The three assistants were engaged in the calculations for the Brera ephemeris, a publication that Struve considered obsolete and pointless. Apart from this, one assistant was also placed in charge of meteorology and another was set the task of studying magnetism. However, their salaries were so meagre that they had to take other jobs in order to make a living, which of course prevented them from concentrating on their scientific research. The situation in other observatories was similar or worse<sup>44</sup> and once again contrasted markedly with the conditions at Pulkovo, where the director was assisted by four senior and two assistant astronomers.<sup>45</sup>

Finally, in his report Struve mentions the historian and Arabist Michele Amari (1806-1889). Amari served as Minister of Public Education of the Italian Kingdom from December 8, 1862 to September 24, 1864. Struve probably met him during his visit to Turin in 1863, as he recalled later in a letter.<sup>46</sup> At this meeting<sup>47</sup> he suggested that the ministry undertake far-reaching reforms of the kingdom's observatories, reducing them to a smaller number of better-organized and properly equipped institutions. Struve may have conceived this plan during the course of his tour of Italy, but similar ideas were already being discussed by Italian astronomers following the country's unification.

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Corrispondenza tra Giovanni Battista Donati e Ottaviano Fabrizio Mossotti," *Atti della Fondazione Giorgio Ronchi*, 2013, 1:15-84.

<sup>41</sup> Giovanni Battista Donati, "Intorno alle strie degli spettri stellari," *Nuovo Cimento*, 1862, 15:292-304.

<sup>42</sup> Angelo Secchi, "Sugli spettri prismatici della luce dei corpi celesti," *Bollettino meteorologico dell'Osservatorio del Collegio Romano*, 1863, 2:108-110, 114-116, 124-126.

<sup>43</sup> The positions consisted of a second astronomer (vacant) and three apprentices ("Allievi"). "Osservatori astronomici e meteorologici," *Annuario della istruzione pubblica del Regno d'Italia per 1863-64* (Brescia: Tipografia del giornale La Sentinella Bresciana, 1864), pp. 617-625.

<sup>44</sup> In 1863 the total number of positions in Italian observatories (excluding those of Rome and Padua) amounted to 25 (counting only the scientific positions and excluding "computers"); among these, one was an unpaid position and 4 were left vacant. Therefore, on average each observatory had 2 to 3 employees, with the exception of Turin, which had a director but no assistants; "Osservatori astronomici e meteorologici" (cit. note 43).

<sup>45</sup> Batten, *Resolute and Undertaking Characters* (cit. note 1), p. 168.

<sup>46</sup> See Appendix 2.

<sup>47</sup> Struve asked Schiaparelli to meet him in Turin, perhaps in relation to his meeting with Amari (cit. note 15). Just after Otto Struve returned to Russia, the minister informed him and his father Wilhelm that they had been nominated knights of the Ordine Mauriziano; Minister of Public Education to O. Struve, Turin, November 2, 1863, Archive of Brera Observatory, *Corrispondenza Scientifica*, cart. 140, n. 13 [to W. Struve in n. 14.]. However, two years later Struve had not yet received his decoration; Struve to Schiaparelli, Pulkovo, December 8, 1865, Abalakin, *Struve-Skiaparelli: perepiska* (cit. note 6), p. 21.

Struve states in his report that Amari was aware of the need to invest in the infrastructure of scientific institutions such as the Brera Observatory and, despite the poor state of the new kingdom's finances, made various decisions which demonstrate his intention to foster the development of astronomy in Italy. Shortly after Struve's visit, Amari presented a parliamentary bill to finance the setting up of the Amici telescope at Florence Observatory.<sup>48</sup> At about the same time the ministry sent a letter to each observatory in Italy, with the request that its director draw up a list of the principal astronomical instruments available in his institute, "the Minister being interested to learn of the state and needs"<sup>49</sup> of each observatory. Was this survey a direct outcome of Amari's conversations with Struve? The inventories were published in the *Annals of the Ministry for 1864*.<sup>50</sup>

#### **4. The use of Struve's report to support the construction of the Arcetri Observatory**

Struve's report on his trip was published in full in 1864 in the journal of the Russian Empire's Ministry of Public Education.<sup>51</sup> Although it was written in Russian, Italian astronomers may have been aware of its existence through the announcement that appeared (in German) in the Pulkovo Observatory's Annual Report for 1864.<sup>52</sup> Donati must have been particularly interested in obtaining a copy of the report. Such was Struve's reputation that his critique of the condition of Italian observatories would have provided strong support for Donati's proposal to build a modern and fully-equipped observatory in the hills just outside of Florence, at Arcetri.<sup>53</sup> Among other reasons, a new building was required to house the Amici telescope on its equatorial mount, the old observatory being inadequate as Struve noted in his report. It may be hypothesized that Donati asked Struve for a copy of his report when they saw each other, during the second meeting (held in Berlin at the beginning of October 1867) of what is now the International Association of Geodesy,<sup>54</sup> because it is known that at the end of October Struve sent Donati a French translation of his report on the state of Italian observatories.<sup>55</sup>

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<sup>48</sup> See note 28.

<sup>49</sup> "Importando al Ministro di conoscere lo stato ed i bisogni di codesto Osservatorio astronomico." Minister of Public Education to the Superintendent of the Istituto di Studi Superiori di Firenze, Turin, February 12, 1864 (Archive of the University of Florence, *Soprintendenza*, 1864, file 17). The same letter can be found in the archives of the Brera Observatory (*Archivio Amministrativo*, cart. 54, n. 422) and the Capodimonte Observatory (*Attività scientifica, strumenti*, B. 3, f. 4). Copies of the lists of instruments that were compiled by the Florence and Brera Observatories in response to this letter are conserved in their respective archives.

<sup>50</sup> "Principali strumenti di astronomia" (cit. note 24).

<sup>51</sup> Struve, "Otchet" (cit. note 5).

<sup>52</sup> Struve, "Wissenschaftliche Reisen" (cit. note 10).

<sup>53</sup> An account of the planning and construction of the Arcetri Observatory can be found in Bianchi et al., "The first Astronomical Observatory of Italy" (cit. note 28).

<sup>54</sup> Both Donati and Struve attended this conference. Carl Christian Bruhns, Wilhelm Julius Foerster, Adolf Hirsch (eds.), *Bericht über die Verhandlungen der vom 30. September bis 7. October 1867 zu Berlin abgehaltenen allgemeinen Conferenz der Europäischen Gradmessung* (Berlin: Reimer, 1868), pp. 3-4.

<sup>55</sup> See note 81.

The first evidence we found of the use of Struve's report is a pamphlet written by the lawyer Ottavio Andreucci (1800-1887) at the beginning of 1868.<sup>56</sup> The purpose of the pamphlet was to support the – in the end unsuccessful – attempt to secure the legacy of the astronomer and engineer Leonardo Ximenes S. J. (1716-1786) for the benefit of the Istituto di Studi Superiori, the academic institute (which later became the University of Florence) on which the Florence Observatory depended. Ximenes wished his legacy to serve as an endowment for the chairs of Astronomy and Hydraulics at the Piarist school in Florence and for the astronomical observatory that he had founded.<sup>57</sup> According to Andreucci it made more sense for the chairs (in particular that of Astronomy) to be transferred to *Istituto* since, if all went to plan, the institute would soon have a new observatory built according to modern specifications. Ximenes' observatory suffered from all the drawbacks noted by Struve in the observatories he had visited, being equipped with obsolete instruments and located on the top of a tall building in a busy urban centre. As the lawyer pointed out, the very fact that Struve did not mention Ximenes' observatory in his report reflected the scant importance he ascribed to it.

The initial part of Struve's report, translated into Italian, was included in an article that Donati wrote for the Florentine newspaper *La Nazione* in 1868<sup>58</sup> in response to the proposal of various journalists and scientists that a large contingent of Italian astronomers be included in the European missions that were being sent to India and Southeast Asia to observe the total eclipse of the sun in August 18, 1868. However, the main purpose of Donati's article was to present the case for completing the new observatory at Arcetri, a project that was experiencing countless bureaucratic delays. The astronomer pointed out that Italian observatories did not possess the necessary instruments to participate in the expedition to Asia, specifically cameras to photograph the solar prominences extending into the corona and spectroscopes mounted on portable equatorial telescopes to determine their chemical composition. The sole exception was the observatory at the Collegio Romano, and therefore only the Papal See would have been able to participate in this mission. The government of the Italian Kingdom would be much better served if it saved its money and used it “to rebuild some of our observatories, transferring them to other sites, and to reform and increase their scientific instrumentation.”<sup>59</sup> To show that he was not arguing solely for

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<sup>56</sup> Ottavio Andreucci, *Del così detto Istituto Ximeniano del nuovo Osservatorio fiorentino e del loro avvenire. Osservazioni storiche e voto* (Firenze: Eredi Botta, 1868). His pamphlet was sent to the Ministry of Public Education on March 10, 1868 (Archive of the Museo Galileo of Florence, ARMU Affari 79, file 29).

<sup>57</sup> The *Osservatorio Ximeniano* was built in 1756 on top of the building that housed the Jesuit Collegio di S. Giovannino. After the suppression of the order in 1773, the Collegio and its observatory were taken over by the Piarist order. Important research was conducted there during the first part of the 19<sup>th</sup> century, particularly under the directorship of Giovanni Inghirami S. P. (1779-1851), but afterwards the observatory limited its activities almost exclusively to geophysics and meteorology. Dino Bravieri, *L'Osservatorio Ximeniano di Firenze* (Firenze: Baccini & Chiappi, 1985).

<sup>58</sup> Giovan Battista Donati, “Della prossima eclisse solare e delle condizioni presenti dell'astronomia pratica in Italia,” *La Nazione*, 25/6/1868.

<sup>59</sup> “[...] riedificare, traslocandoli, alcuni dei nostri Osservatorii, e di riformarne ed aumentarne il materiale scientifico,” Donati, “Della prossima eclisse solare” (cit. note 58). Donati's article is said to have extinguished any hope of public funding for Italian astronomers to participate in the observation of the 1868 solar eclipse. However, in the same article Donati expressed support for the plan to send a team to observe the eclipse that would be visible from Sicily on

the benefit of the observatory in Florence, Donati cited the judgements expressed by Struve “with all his highest authority.”<sup>60</sup>

Struve’s report was brought to the attention of MPs interested in promoting the development of science in Italy. At the beginning of 1869 his words were quoted by Domenico Berti (1820-1897) in a report presented to the Chamber of Deputies. on behalf of the General Commission for the State Budget in support of a proposed bill to finance the construction of the Arcetri Observatory.<sup>61</sup> Another member of the General Commission, Angelo Messedaglia (1820-1901), referred to Struve’s report during discussions in the Chamber of Deputies of the 1869 budget for the Ministry of Public Education. In his presentation Messedaglia lamented the excessive number of the scientific institutions inherited from the pre-unitarian states and the dearth of funding and research equipment.<sup>62</sup> Struve’s views were incorporated into a later version of this report.<sup>63</sup> From the text written by the two deputies, it is evident that they had read Struve’s report through Donati’s translation.

On October 19, 1871 Struve visited the construction site of the new observatory at Arcetri.<sup>64</sup> The building was already half completed and the metal base of the Amici telescope was being mounted. Donati, however, expressed discouragement at the slow progress being made, which he blamed on the countless

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December 22, 1870, a mission that was in the end funded by the Italian government. Ileana Chinnici (ed.), *L’Eclisse totale di Sole del 1870 in Sicilia. Lettere di Pietro Tacchini a Gaetano Cacciatore* (Palermo: Eurografica, 2008), p. 24-26.

<sup>60</sup> “[...] con tutta la sua grandissima autorità” in Donati, “Della prossima eclisse solare” (cit. note 58).

<sup>61</sup> Domenico Berti, “Relazione della commissione generale del Bilancio sul progetto di legge presentato dal ministro delle finanze nella tornata del 21 gennaio 1869, stampato N. 254-A,” in *Parlamento Italiano, Camera dei deputati. Legislatura X, sessione 1867-68 dal 22 marzo 1867 al 20 agosto 1869. Raccolta dei documenti stampati per ordine della Camera* (Firenze: Eredi Botta, 1869). The parliamentary bill to fund the Arcetri Observatory was approved by the House of Deputies on May 25, 1869, but was not voted on in the Senate due to the adjournment of the parliamentary session in June. It was issued as a royal decree on September 23, 1869 and a bill for approval of the decree was presented to the Parliament. A fresh report on behalf of the General Commission for the State Budget was presented to the House of Deputies in 1870, this time by the Deputy PM Messedaglia; see Angelo Messedaglia, “Relazione della commissione generale del Bilancio sul progetto di legge presentato dal ministro delle finanze nella tornata del 10 marzo 1870, stampato No. 34-A,” in *Parlamento Italiano, Camera dei deputati. Sessione 1869-70, Seconda della X legislatura. Raccolta dei documenti stampati per ordine della Camera* (Firenze: Eredi Botta, 1869). Messedaglia cites Struve to underline the importance of this project, but the bill was never voted on. Bianchi et al., “The first Astronomical Observatory of Italy” (cit. note 28).

<sup>62</sup> The sitting of the House of Deputies on May 11, 1869. *Rendiconti del Parlamento Italiano, Sessione del 1867-1868 (prima della legislatura X). Discussione della Camera dei Deputati, Vol. X dal 3 maggio al 17 giugno 1869* (Firenze: Eredi Botta, 1869), p. 10551.

<sup>63</sup> Angelo Messedaglia, *Il bilancio della pubblica istruzione del Regno d’Italia per l’anno 1869. Relazione alla Camera dei Deputati del deputato Prof. Angelo Messedaglia a nome della Commissione generale del bilancio* (Milano: Tipografia e Litografia degli Ingegneri, 1869).

<sup>64</sup> “È in Firenze Struve, astronomo di Pulckova, [...] col quale stamani debbo andare a visitare l’Osservatorio Nuovo” (Struve, astronomer of Pulkovo, is in Florence; this morning we will visit together the New Observatory). G.B. Donati to S. Gherardi, Florence, 19/10/1871 (Biblioteca Comunale F. Trisi, Lugo (Ravenna), Italy, Fondo Gherardi, Collezione degli autografi, I-XIV-A, Busta 37, n. 1286).

administrative regulations of the ministry and on the fact that the project was already over budget and would require fresh funding.<sup>65</sup> Struve must nevertheless have been positively impressed for in a letter written just a few days later, on October 22 (see Appendix 2 for a transcription of this letter), Struve assured Donati that the new institute fit in well with the scheme for the development of astronomy in Italy that he had proposed to the Minister for Public Education in 1863. Although Donati's budget only allowed for the construction of a modest-sized building, its location and layout met the requirements of a modern observatory, on the condition that the Amici telescope was complemented by a meridian circle and other instruments. The Italian government, Struve concluded, would surely not leave the observatory unfinished.

It would appear clear that Struve wrote this letter at the behest of Donati, as the latter almost immediately made use of it. On October 24 he dispatched a copy to the Minister of Public Education, together with other documents on the status of the project, although it seems that this material was lost in transit and never reached its destination.<sup>66</sup>

It is not easy for us to judge today what influence Struve's report may have had on the development of the science of astronomy in Italy in general and on the construction of the Arcetri Observatory in particular. Donati obviously considered it to have been crucial, because in his plans for the inauguration of the new observatory he reserved a place of honour for Struve. On October 2, 1872 he wrote to the eminent astronomer:

Le 20 prochain<sup>67</sup> à 10h du matin on fera l'inauguration solennelle du Nouvel Observatoire de Florence. Je me suis souvent aidé avec profit de votre Rapport sur les Observatoires Italiens, pour persuader qu'il fallait construire ce Nouvel Observatoire. Je dirai ça dans mon discours d'ouverture; et j'ai déjà proposé qu'en cette occasion le Gouvernement Italien vous donne la Décoration<sup>68</sup> que vous méritez<sup>69</sup>.

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<sup>65</sup> Bianchi et al., "The first Astronomical Observatory of Italy" (cit. note 28), p. 63. Donati asked the municipality and the provincial government of Florence to throw their support behind this project and both responded by expressing their satisfaction with the work in progress and by sending requests to the Ministry of Public Education for an increase in the budget for the observatory (Ubaldo Peruzzi, mayor of Florence, to Donati, Florence, 6/9/1871; resolution of the Deputazione Provinciale of 23/9/1871; Archive of the Province of Florence, Carteggi, 320, 111).

<sup>66</sup> The loss of the documents sent by Donati on October 24, 1871 is mentioned in the draft of a letter written by Donati to the Minister of Public Education on March 29, 1872 (Archive of the Arcetri Observatory, Fondo Donati, 1013).

<sup>67</sup> The inauguration was eventually postponed to October 27. Simone Bianchi, Daniele Galli, Antonella Gasperini, "Le due inaugurazioni dell'Osservatorio di Arcetri," *Giornale di Astronomia*, 2013, 39, 3:19-30.

<sup>68</sup> The Superintendent of the Istituto di Studi Superiori submitted a request to the Minister of Public Education that a decoration of the highest order be bestowed upon Struve. This request was passed to the Minister of Foreign Affairs (Archive of the University of Florence, *Verbali delle Adunanze del Consiglio Direttivo*, November 19 and December 3, 1872). Like the knighthood bestowed in 1863 on Struve and his father (cit. note 47), we can find no further trace of this decoration.

<sup>69</sup> Donati to Struve, Florence, October 2, 1872, Archive of the Russian Academy of Science, St. Petersburg branch, F.286 Op. 1. D.236, 21.

At the time Struve was in Paris attending the congress of the *Commission Internationale du Metre* and was unable to decide whether he would be able to participate in the ceremony, as he did not yet know when the commission would finish its work and because he was expecting an invitation from the Astronomer Royal George Biddel Airy (1801-1892) to visit England.<sup>70</sup> In the end he did not attend the inauguration but he was mentioned in the most laudatory of terms in Donati's speech:

Here came, among others, Struve, the illustrious Russian astronomer who, in the several reports his Government asked him on the state of practical astronomy in the numerous countries he visited, never ceased to deplore the miserable conditions of Italian observatories, and whose authoritative voice, having been heard by our own Government, certainly had not a small influence on the conception and realization of this Observatory.<sup>71</sup>

## 5. Conclusions

A decade after Struve's visit the conditions of Italian astronomy had not changed significantly. When the French astronomer Georges Rayet (1839-1906) made a tour of Italian observatories in 1875,<sup>72</sup> he reported the same problems that Struve had found and which were a legacy of the peninsula's past history: unstable buildings, too many institutes, and too little funding to acquire the sophisticated instruments necessary to compete with the national observatories of Greenwich, Paris, Pulkovo, Berlin, and Washington.<sup>73</sup> He noted a few improvements – Brera and Palermo had installed their new refractors, a 3-foot meridian circle by Repsold was set up in Capodimonte, and Florence had a completely new observatory – but an overall plan for the reorganization of astronomical research on a national level was still lacking.

In September 1875 Rayet sat in on a meeting of Italian astronomers in Palermo, which had been convened to discuss a project drawn up by Tacchini to raise the calibre and status of astronomical research in Italy. The first step would be to take four observatories (Tacchini proposed those of Brera, Arcetri, Capodimonte and Palermo) and completely modernize them with financing from the Ministry of Public Education, so that they could conduct practical astronomical research at the level of the best observatories in Europe. Other observatories could serve a supporting role training a new generations of astronomers as scientific cabinets of local universities

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<sup>70</sup> Struve to Donati, Paris, October 8, 1872, Biblioteca Nazionale Centrale di Firenze, Carteggi Vari, 326, 11. The English astronomer was a close friend of both Wilhelm and Otto Struve and godfather to Otto's eldest son, see Batten, *Resolute and Undertaking Characters*, (cit. note 1), pp. 90-91.

<sup>71</sup> “Venne qui, fra gli altri, lo Struve, insigne astronomo russo, il quale in varie relazioni richiestegli dal suo Governo intorno allo stato in cui trovasi l'astronomia pratica nei molti paesi da lui visitati, non ha mai cessato di deplorare le condizioni infelici degli Osservatorii italiani, e la cui voce autorevole, essendo giunta fino al nostro governo, ha certamente avuto una non lieve influenza nel concepimento e nell'attuazione di questo Osservatorio nostro.” Donati, *Parole pronunziate il dì 27 ottobre 1872* (cit. note 4), p. 5.

<sup>72</sup> Rayet's tour of Italy constituted part of a mission to visit various European and American observatories with a view to drawing up plans for the re-organization of astronomical research in France. Laetitia Maison, “Les observatoires italiens en 1875 un exemple pour le renouveau de l'astronomie française?” *Nunciatus*, 2003, 18:577-602.

<sup>73</sup> Rayet, *Observatoires d'Italie* (cit. note 20), pp. v-viii.

(at a relatively modest cost); a few institutes, instead, should have been converted into meteorological observatories. This project was in line with the recommendations made by Struve to the Minister of Public Education, Michele Amari, in 1863. Tacchini's proposal was adopted as a Royal decree in 1876, but was never put into effect.<sup>74</sup> The institutes of astronomy therefore maintained their quintessentially Italian profile for another century, until the foundation of the National Institute for Astrophysics in 1999.<sup>75</sup>

The multiplicity of institutes at least had one positive effect according to Rayet, that of encouraging healthy competition among researchers. The Frenchman also praised the collaboration between Italian astronomers in studies of solar spectroscopy, as reflected in the creation of the *Società degli Spettroscopisti Italiani* by Tacchini and Secchi in 1871. In the wake of their activities, it was proposed that research at the Arcetri Observatory should concentrate entirely on astrophysics. Unfortunately, following the death of Donati in 1873, the observatory was left incomplete and with a vacant directorship, thus placing at risk his plans to make Arcetri one of the great national observatories of Europe, dedicated to classical positional astronomy. Schiaparelli, who served as scientific counsellor to the observatory during the early period of its activities in the absence of a director, was in entire agreement with this goal. He was supported by Struve who, when called upon to give his opinion, said that it was too early to dedicate the resources of a large observatory entirely to astrophysics, a field that was still in its infancy and had not yet achieved the mathematical rigor of positional astronomy, an “exact science par excellence.”<sup>76</sup>

Despite these authoritative recommendations, Arcetri never managed to acquire state-of-the-art measuring instruments such as a large meridian circle. In 1921, with a solar tower in construction, the observatory was finally dedicated to astrophysics and its name was changed from *Osservatorio astronomico* to *Osservatorio astrofisico*.<sup>77</sup>

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<sup>74</sup> Francesco Poppi, Fabrizio Bònoli, Ileana Chinnici, “Il progetto Tacchini e la riforma degli osservatori italiani,” in *Cento anni di Astronomia in Italia*, Atti dei convegni Lincei 217 (Roma: Bardi, 2005), pp. 123-171.

<sup>75</sup> Pigatto, “Gli Osservatori Astronomici nell'Italia unita” (cit. note 22).

<sup>76</sup> “[...] scienza esatta per eccellenza,” Struve to Schiaparelli, January 15 1875, transcribed in Simone Bianchi, Daniele Galli, Antonella Gasperini, *Giovanni Virginio Schiaparelli e l'Osservatorio di Arcetri* (Firenze: Fondazione Ronchi, 2011), pp. 84-86. Struve however declared himself not to be an enemy of the nascent science. In fact, despite having been accused of neglecting astrophysics, he was responsible for its introduction in Pulkovo. Batten, *Resolute and Undertaking Characters* (cit. note 1), p. 173.

<sup>77</sup> For the early history of the Arcetri Observatory and Schiaparelli's contribution, see Bianchi, et al., *Schiaparelli e Arcetri* (cit. note 76).

## Appendix 1. Struve's report on Italian observatories<sup>78,79</sup>

### II.<sup>80</sup> Les Observatoires astronomiques en Italie<sup>81</sup>

A l'exception de la Grande Bretagne il n'y a pas au monde d'autre pays aussi riche en Observatoires astronomiques que l'Italie. [Lors de mon voyage à Malte, j'ai visité presque]<sup>82</sup> tous ceux d'entre eux qui jouisse d'une certaine notoriété nommément ceux de Milan, Palerme, Naples, Rome, Florence, Bologne, Turin et Padoue. A juger par le nombre des Observatoires il y aurait lieu de supposer que l'astronomie pratique se trouve en Italie dans un état très florissant – mais la réalité ne confirme pas cette attente. Au contraire cette science, comme plusieurs autres, s'est trouvée pendant de longues années, en état de décadence parfaite, et ce n'est pas que depuis très peu de temps qu'elle commence un peu à se développer en Italie. Il n'y a pas de doute que les conditions politiques, dans lesquelles ce pays s'est trouvé si longtemps, ont contribué très fortement à cet état de la science. Il paraît que dans une certaine période un sentiment de rivalité louable a poussé les différents gouvernements et même des provinces isolées à ériger chez eux des observatoires et à les doter d'instruments qui dans ce temps avaient une grande renommée; mais les forces matérielles des parties isolées ne suffisaient pas pour maintenir les observatoires dans une activité régulière et pour les progrès de la science et de la technique. Il y a aussi lieu de supposer que même à l'époque de l'érection de ces observatoires, ce ne fut qu'exceptionnellement que les gouvernements respectifs se sont formés de justes idées sur la destination future de ces établissements, sur les problèmes qu'il y aurait lieu de poursuivre, et que ne fut qu'au désir indéterminé de contribuer au progrès de l'astronomie qu'ils doivent leurs origine. C'est à ces circonstances qu'il faut l'attribuer ainsi que parmi les observatoires nommés il n'y trouve pas un seul dont la construction duquel aient été prises en considération les conditions qui déjà depuis plus d'un demi-siècle ont été reconnues par le monde scientifique comme indispensables pour le succès et l'exactitude des observations. Cependant l'équité demande d'ajouter que plusieurs de ces observatoires ont déjà été fondés dans le siècle passé et que dans le siècle actuel ils n'ont subi que des réorganisations qui, par malheur, n'ont pas été assez fondamentales. Tous ces observatoires se trouvent à l'intérieur et plusieurs d'entre eux presque au centre de grandes villes, en proximité des rues les plus fréquentées. Par cette raison, à fin de donner aux astronomes la possibilité d'une vue libre de toute la voûte céleste, on était obligé de les ériger dans les étages supérieurs des maisons les plus hautes ou sur d'anciennes tours. Evidemment ces deux circonstances, la

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<sup>78</sup> Archive of the Russian Academy of Science, St. Petersburg branch, F.286 Op. 1. D.236, 13-18.

<sup>79</sup> In the transcription of this document (Appendix 1) and in the letter reproduced in Appendix 2, we use square brackets to mark integrations, passages that are illegible ([...]), uncertain transcriptions ([prononcer?]) and divergences from the commonly accepted spelling or rules of grammar ([sic]).

<sup>80</sup> The numbering should have referred to that in the original publication in Russian, but the report on Italian observatories is numbered 'part III' in Struve, "Otchet" (cit. note 5).

<sup>81</sup> A handwritten note at the top of the first page reads: "An Donati gesandt Ende October 1867. [...] Bericht über meiner Reise 1863."

<sup>82</sup> Illegible in the original document. The French text has been reconstructed from the Italian translation in Donati, "Della prossima eclisse solare" (cit. note 58).

proximité des rues les plus fréquentées, et l'hauteur des édifices, devaient être préjudiciables à l'établissement solide des instruments, conditions indispensables pour l'exactitude de beaucoup d'observations.

Le seul observatoire de Naples forme une exception par rapport aux conditions locales. Etant situé dans un endroit plus isolé, sur la pente d'une colline à Capodimonte, et à la hauteur d'environ 400 pieds au dessus du niveau moyen de la ville, il a été possible de placer les piliers des instruments, même dans les étages supérieurs sur le roc naturel de la colline. Mais malgré ces conditions favorables, aussi cet observatoire ne satisfait aucunement aux exigences de la science moderne ni dans la construction ni par rapport aux instruments dont il est doté.

Il paraît que le rétablissement de la paix en Europe, en 1815, a beaucoup contribué à la fondation ou plutôt à la réorganisation des observatoires d'Italie. En effet nous voyons que vers cette époque presque tous les observatoires ont été pourvus de nouveaux instruments en grande partie confectionnés par l'industrie Reichenbach de Munich dont l'activité dans le champ de la mécanique pratique ne date que de peu d'années avant cette époque. On pourrait peut-être s'étonner que presque tous les gouvernements Italiens au même moment commençaient à faire des efforts pour la culture de l'astronomie, mais ce phénomène s'explique par le fait qu'à la même époque où les nations, après des troubles prolongés, se trouvaient en mesure de s'occuper de nouveau des conquêtes paisibles de la science, ce fut pourtant l'astronomie qui en Italie excita l'intérêt général par suite des travaux immortels de Piazzi, exécutés à Palerme au commencement de ce siècle<sup>83</sup>. Mais pour faire avancer la science il ne suffit pas d'ériger des observatoires et de les fournir d'instruments, il faut avoir aussi des gens qui savent faire un usage utile de ces moyens, et malheureusement il n'y a pas en Italie d'école astronomique dans la première moitié de ce siècle. A cela j'ajoute, si je ne me trompe, qu'un patriotisme mal compris ou peut-être aussi le fanatisme religieux, ont empêché pendant très longtemps l'introduction dans ce pays des progrès de la science et de la technique faits dans les autres pays. Ce ne fut que les dernières années qui, avec le changement de l'état politique du passé, ont effectué également un changement heureux dans les conditions où se trouvait jusque-là la science en Italie et son effet commence déjà à se [prononcer ?] par une activité fructueuse de plusieurs de ces observatoires.

Etant entré en Italie par la Suisse, j'ai visité d'abord l'observatoire de Milan, fondé vers 1770 par les Jésuites. Par rapport au nombre des instruments, cet observatoire est le plus riche en Italie. Mais, par malheur, dans ce nombre il n'y a pas un seul qui à l'époque actuelle pourrait être considéré comme satisfaisant complètement aux exigences de la science, et l'établissement des instruments en différentes tourelles, sur le toit ou en différentes salles de l'ancien palais de Brera (autrefois collège des Jésuites) est au plus haut degré inconvenient. D'autant plus y a-t-il lieu de reconnaître l'activité utile qui dans ces conditions défavorables y vient de développer le directeur actuel M. Schiaparelli qui en 1859 et 60 a été notre collaborateur à Poulkova. Par cette activité il s'est acquis en comparativement très peu de temps un nom honorable dans la science et la confiance de son gouvernement.

Jusqu'à présent l'Observatoire de Milan ne possède pas [une seule ?] lunette achromatique de dimensions assez grandes pour faire avancer la science dans son état actuel. Maintenant un réfracteur de 8 pouces de diamètre vient d'être commandé chez

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<sup>83</sup> The text was translated into Italian up to this point in Donati, "Della prossima eclisse solare" (cit. note 58).

M. Merz à Munich, et son arrivée est attendue dans le courant de l'année prochaine et pour le recevoir un tour mobile de 18 pieds de diamètre y est déjà construit. En attendant l'arrivée de cet instrument, M. Schiaparelli s'occupe comme observateur de la confection d'un catalogue de toutes les étoiles jusqu'à la grandeur 7.5 inclusivement, qui se trouvent dans la zone  $-2^{\circ}$  à  $+6^{\circ}$  de déclinaison. L'instrument dont il se sert pour ce travail est un cercle méridien fait par M. Starke à Vienne. Malheureusement l'installation de cet instrument est très défectueuse pour plusieurs [rapports ?] et en outre par établissement est très peu solide, ce qui oblige l'observateur de se contenter de déterminations différentielles. Grâce au zèle de M. Schiaparelli, le travail qui demande environ 10000 observations avance rapidement et il y a lieu d'espérer qu'il sera achevé dans le courant de l'année prochaine.

Le nombre des aides du directeur de l'observatoire de Milan est fixé à 4, mais du temps de ma visite il n'y en avait que trois; la quatrième place étant laissée vacante afin de faire des économies pour avoir les moyens de réparer les instruments et pour d'autres besoins urgents. Les appointements de ces aides sont en général extrêmement modiques, de sorte que, pour leur existences, ils sont obligés de s'occuper de travaux étrangers à l'observatoire et par conséquent leur activité astronomique à l'observatoire en souffre beaucoup. Leur obligation principale à l'Observatoire consiste à calculer les éphémérides de Milan; en outre un aide est chargé des observations météorologiques, un autre des observations magnétiques. La publication des éphémérides est obligatoire à l'Observatoire par le testament de feu le Directeur Oriani qui, avec cette condition, lui avait légué une somme de 200,000 liras, dont les intérêts servent à l'entretien de l'établissement. Aujourd'hui la publication de ces éphémérides n'a plus la même importance qu'elle avait 50 ans d'ici [sic]; par cette raison il y aurait lieu de souhaiter que ces éphémérides fussent modifiées à tel point que sans manquer aux conditions stipulées par le légataire, une plus grande partie des intérêts peut être affectée à d'autres entreprises plus utiles de l'Observatoire.

L'Observatoire de Milan n'étant en aucune relation administrative ni avec l'Université de cette ville ni avec l'Institut de Lombardie, se trouve placé directement sous les ordres du Ministre de l'Instruction Publique. Il parut que le Ministre actuel, le savant historien M. Amari, désire beaucoup pouvoir améliorer l'état de cet observatoire en lui fournissant les moyens pour une activité plus étendue et plus fructueuse, mais jusqu'à présent la situation financière du royaume le gêne beaucoup dans ces projets. Dans mon opinion le premier pas à faire devrait consister dans l'érection d'un nouvel édifice dans les environs de la ville, où les instruments pouvaient être placées sur des fondements solides.

De Milan je me suis rendu à Palerme en passant pour Gênes. Dans cette ville commerciale il n'y a pas d'observatoire, mais le gouvernement a l'intention d'y faire construire un de petites dimensions pour l'usage de la marine, d'après un plan proposé par M. Schiaparelli.

L'Observatoire de Palerme est construit à la fin du siècle passé sur le toit du palais royal d'après les indications du célèbre Piazzini. Le palais occupe une position assez isolée à l'extrémité sud de la ville. Sa face est tournée vers une place de grandes dimensions, sur laquelle il n'y a ordinairement que très peu de mouvement, tandis que des trois autres côtés il est entouré d'un jardin. Ces conditions favorables, ainsi que l'épaisseur énorme des murs du palais, permettent de supposer que l'établissement des instruments y peut être suffisamment solide, même pour des déterminations absolues. Si cette supposition se confirmera par l'expérience, de tous les observatoires d'Italie, celui de Palerme est probablement celui qui le plus facilement pourra être mis

en tel état qu'avec l'espoir d'un plus grand succès il pourra participer dans les travaux de l'astronomie moderne. Pour ce but il est déjà pourvu de tous les instruments nécessaires. En 1856 un nouveau cercle méridien fait par Pistor et Martins de Berlin, de trois pieds de diamètre y a été établi, et un réfracteur de Munich, avec une ouverture de 9 pouces, comme celui de Dorpat, s'y trouve également. Ce dernier instrument n'a pas encore été ôté des boîtes, dans lesquelles il a été transporté de Munich, mais la tour mobile et le pilier en marbre qui devra le porter, sont déjà achevés.

Avec des sentiments pour ainsi dire de vénération j'ai regardé à Palerme le cercle de Ramsden, à l'aide duquel Piazzi a fait les grandes séries d'observations qui nous ont fourni les positions des étoiles fixes pour la fin du siècle passé et le commencement du siècle présent, à une époque où des déterminations analogues ne se faisaient nulle part avec la même exactitude. Cet instrument se trouve encore dans la même localité, où il a été employé par Piazzi et paraît être très bien conservé. A ce que me dit le directeur actuel M. Gaetano Cacciatore, fils de Nicolas, dont le nom est bien connu comme collaborateur de Piazzi, aucun changement n'a été introduit dans cet instrument, depuis le commencement de ce siècle, et aucune réparation de quelque importance n'y a pas [sic] été faite, de sorte qu'on peut bien affirmer qu'encore aujourd'hui l'instrument se trouve exactement dans les mêmes conditions dans lesquelles il a servi à Piazzi. Cette circonstance donne la possibilité d'examiner encore aujourd'hui exactement les erreurs systématiques dont l'existence dans les observations Palermitaines a été reconnue par la comparaison avec d'autres catalogues, et d'introduire ainsi les corrections nécessaires au catalogue de Piazzi, ce qui serait de la plus haute importance pour l'astronomie stellaire.

Ces corrections peuvent être déterminées ou par un examen rigoureux de toutes les parties de l'instrument comme par ex[ample] de la division du cercle et des verniers, de la flexion de la lunette, etc., ou par des observations simultanées faites sur les mêmes objets célestes, avec cet instrument et un autre dont toutes les corrections sont déjà connues exactement. Ayant discuté cette affaire avec M. Cacciatore, nous sommes parvenus à la conclusion qu'à l'époque actuelle la dernière méthode serait préférable et plus facile à faire. Il y a lieu d'espérer que sous peu dans ce sens des séries d'observations seront entreprises à Palerme, pour lesquelles dans ce cas les déterminations correspondantes seraient exécuté a Poulkova. En 1842 M. Gaetano Cacciatore à [sic] succédé à son père dans la direction de l'Observatoire de Palerme. Ayant pris une part active dans la révolution de 1848, il a été obligé de se cacher l'année suivante à l'intérieur de l'île de Sicile. Ici il a passé 12 ans sans pouvoir se procurer de livres et sans aucune relation avec le monde scientifique. On peu bien s'imaginer que dans ces conditions il n'a pu suivre la marche de la science et lui-même il en convient franchement. Après la révolution de 1860 il est de nouveau rentré dans les fonctions de Directeur; mais dans l'état où se trouve encore le pays ses efforts en faveur de la science n'ont eu encore presque aucun succès de quelque importance; mais au moins on peut appeler succès que dans ce temps il a réussi à remettre l'observatoire en bon ordre.

D'après les règlements de l'Observatoire le Directeur doit avoir un aide, mais jusqu'à mon arrivée M. Cacciatore a été seul à l'Observatoire. Ce ne fut que quelques jours plus tard qu'un aide lui a été assigné dans la personne de M. Tacchini élève de M. Santini à Padoue et qui dans les dernier temps avait temporairement administré l'observatoire de Modène. Ayant eu l'occasion de faire la connaissance personnelle de M. Tacchini, j'ai gagné la conviction qu'avec son zèle et ses connaissances il sera

bien en état de reconquérir à l'observatoire de Palerme un nom honorable dans la science. A cette occasion je mentionnerai encore qui nous sommes tombés d'accord avec Mm. Cacciatore et Tacchini qui à coté de l'examen du cercle de Ramsden, un des premier travaux à entreprendre devait être une extension depuis l'équateur jusqu'au parallèle de 30° de déclinaison australe, de la [révision ?] de la voute céleste que nous avons exécuté à Poulkovo en 1840-43 pour l'hémisphère boréal. Il n'y a pas de doute qu'un pareil travail conduirait [encore ?] à la découverte d'un très grand nombre de systèmes binaires d'étoiles.

Par rapport à l'Observatoire de Naples il a déjà été mentionné plus haut que c'est le seul observatoire Italien dans lequel la pente de la colline a permis de placer les fondements et piliers des instruments directement sur le sol naturel. Aussi sa position isolée à Capodimonte est un grand avantage. Mais d'un autre côté les moyens instrumentaux y sont extrêmement faibles et insuffisants. La bâtisse de l'Observatoire a été achevée en 1818 et évidemment tous les instruments dont il est muni encore aujourd'hui ont été construits dans la période de 1814 à 1818. Parmi ces instruments se trouve entre autres, au dire des astronomes Napolitains, le premier cercle méridien confectionné par Reichenbach, dans lequel l'alidade [sic] est encore remplacée par deux bras qui portent les verriers. Aussi un petit réfracteur de Fraunhofer, avec un objectif de 7 pouces, appartient évidemment à la première période de l'activité de l'immortel artiste. M. de Gasparis, second astronome, pense que l'objectif est bon, mais à défaut d'un état convenable, il n'y a presque pas moyen de l'employer. La tour mobile, dans laquelle il est établi, est également d'ancienne construction et très défectueuse. Le seul équatorial de Reichenbach, avec un objectif de 3 pouces, à l'aide duquel M. de Gasparis a découvert un grand nombre d'astéroïdes, se trouve dans un état satisfaisant; mais dans sa construction aussi cet instrument ne satisfait pas aux exigences de la science moderne.

Le Directeur actuel de l'Observatoire M. Capocci a été également destitué de son emploi dans les derniers temps du gouvernement des Bourbons et il n'y a que deux ans qu'il est retourné dans ses fonctions. Sous ses ordres se trouvent trois aides, dont le plus ancien est M. de Gasparis.

Il parait qu'en général à Naples, à défaut d'instruments suffisants on ne s'occupe pas d'observations proprement scientifiques. La seule recherche d'astéroïdes constitue l'unique objet de leurs travaux pratiques. À cet effet M. de Gasparis a l'intention de faire dresser une carte exacte de la partie du ciel comprise entre 17 et 19 heures d'ascension droite et de 15° de large. D'autres travaux ou entreprises scientifiques n'ont pas été mentionnées avec moi.

De Naples je me suis rendu à Rome. Ici il y a deux observatoires, l'un appartenant au collège des Jésuites, connu sous le nom de Collège Romain, l'autre en relation avec l'Université (Sapienza). Le premier de ces deux établissements m'a fait une impression très favorable par l'esprit éminemment scientifique qui y domine, grâce aux efforts du Directeur, le Rev. P. Secchi, connu au monde scientifique par des nombreux [travaux ?] en différentes branches d'astronomie et de physique, dans l'exécution desquels il est assisté par deux autres membres de la Société Jésus Mm. Rosa et Marnetti [sic, but Marchetti]. Dans les dernières années ils se sont occupés par préférence de recherches de physique d'optique et de météorologie, objets pour lesquels M. Secchi, comme ancien professeur de physique au Collège, avoue d'avoir une prédilection. A cet effet l'Observatoire est pourvu d'une collection très complète d'instruments de météorologie et d'autres appareils de physique. Au nombre des instruments astronomiques il fait citer en premier lieu un réfracteur de 9 pouces

d'ouverture, dont les excellentes qualités optiques sont prouvées par de nombreuses mesures d'étoiles doubles très resserrées. En outre il y a encore un ancien réfracteur de Cauchoix de 6 pouces d'ouverture, dont on se sert maintenant pour dessiner les tâches solaires et un cercle méridien de Reichenbach et Ertel de deux pieds de diamètre.

L'Observatoire est érigé au [sic] haut du Collège Romain. Malgré l'extraordinaire hauteur de cet édifice, l'emplacement des instruments est assez solide, comme les salles d'observation se trouvent en dedans des tours d'une épaisseur énorme qui jadis ont été destinés à porter l'immense coupole d'une église, qu'on avait eu l'intention de construire au 17<sup>ème</sup> (?)<sup>84</sup> siècle. Il y a quatre de ces tours, dont deux seulement sont maintenant occupées par l'observatoire. De tous cotés elles sont entourées jusqu'en haut par d'autres bâtiments du Collège, ce qui les abrite contre l'influence des changements de température et des rayons du Soleil.

L'autre observatoire de Rome est situé sur le toit de l'ancien Capitole, dont les murs, même sous le toit ont encore une épaisseur de 8 pieds. Quoique formant partie de l'Université de Rome, cet observatoire ne sert aucunement à l'enseignement; il a plutôt l'air d'être construit uniquement pour le plaisir du vieux directeur l'Abbé Calandrelli qui de temps à autre s'amuse à y regarder le ciel.

Pour cette raison il n'y a pas lieu d'attendre de cet établissement beaucoup de fruits pour la science. L'Observatoire construit dans les dernières années est pourvu d'un cercle méridien d'Ertel fils de 2 pieds de foyer<sup>85</sup> et d'un petit réfracteur de Merz avec un objectif de 5 pouces d'ouverture.

L'Observatoire de Florence est également très peu favorablement situé sur le toit et dans une tour d'une maison très haute qui appartient au Musée des Sciences naturelles. Et quant aux instruments sa dotation est au plus haut degré insuffisante. D'autant plus y a-t-il lieu de reconnaître que le Directeur actuel, M. Donati, par un usage circonspect et diligent de ces faibles moyens a su gagner dans le courant de quelques années un nom très honorable dans la science.

Le prédécesseur de M. Donati, feu M. Amici, connu particulièrement pour ses travaux en optique, s'est occupé par préférence de la construction d'appareils optiques, d'objectifs, de microscopes, etc. Un objectif qu'il avait construit d'une ouverture de 10.5 pouces est maintenant acquis pour l'Observatoire de Florence. Il y a lieu de supposer que cet objectif est de bonne qualité, mais le tube n'étant pas encore monté, des expériences directes n'ont pas encore été faites à ce sujet. Aussi n'y a-t-il pas moyen de monter dans l'édifice actuel un instrument de pareilles dimensions avec la [perspective]<sup>86</sup> d'obtenir à son aide des résultats satisfaisants.

Pour l'observation des comètes et des petites planètes M. Donati n'a à sa disposition qu'un ancien équatorial de Sisson. Les positions des étoiles de comparaison ne peuvent être déterminées à Florence que d'une manière grossière à l'aide d'un cercle vertical de Reichenbach.

À côté de ces instruments il y a encore à Florence un ancien réflecteur de Herschel avec un miroir de 8 pouces d'ouverture et établi sur un pied équatorial. M. Donati a appliqué à cet instrument un appareil photographique et en a fait ainsi un photohéliographe dont il pourrait se servir avec avantage. Malheureusement il n'y a

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<sup>84</sup> The question mark is Struve's.

<sup>85</sup> This should have read "diamètre".

<sup>86</sup> The word "perspective" was crossed out by Struve, but word that takes its place is illegible.

pas moyen de faire régulièrement les photographies du Soleil, car M. Donati n'a point d'aide et lui même il n'a aucun logement à l'Observatoire.

Sous l'Observatoire se trouve une salle consacrée à la mémoire de Galilée, Torricelli et d'autres célébrités de Florence. C'est là qu'on peut voir entre autres le premier télescope construit par Galilée, à l'aide duquel il a découvert les satellites de Jupiter. Il y a là aussi une lentille d'environ un pied de diamètre, dont, au dire de M. Donati, les savants Florentins se sont servi à la fin du 17<sup>ème</sup> siècle dans les expériences pour la combustion du diamant. Cette même lentille dont le foyer n'est que de 4 pieds, a été appliquée par M. Donati à un statif parallaxique pour examiner à son aide les spectres stellaire et c'est par ces faibles moyens qu'il a fait les premiers pas dans ces recherches également délicates et importantes.

L'Observatoire actuel de Bologne, construit déjà au commencement du siècle passé, appartenait à l'Université de cette ville. Sous la direction de Manfredi et Zanotti il avait acquis une réputation étendue par la publication d'utiles éphémérides astronomiques, mais peu à peu il a disparu du nombre des observatoires actifs de sorte que de 1833 à 1859 on n'a pas même jugé nécessaire de remplir le poste vacant de Directeur. Actuellement cette place est donnée à M. Respighi dont le nom est connu pour la découverte de plusieurs comètes. L'Observatoire étant érigé sur le toit de l'édifice principal de l'Université, l'emplacement des instruments est très peu solide. Ici également les moyens instrumentaux sont très faibles. L'instrument principal est un cercle méridien de 2 pieds de diamètre par l'atelier de Reichenbach et Ertel. M. Respighi s'est servi de cet instrument pour déterminer exactement la latitude de son observatoire. Pour atteindre un plus haut degré d'exactitude il a eu recours à un moyen extraordinaire. En faisant attention à la circonstance que l'étoile luisante  $\alpha$  Cygni passe pour le méridien à la distance de quelques minutes seulement du zénith de son lieu d'observation, l'idée lui est venue de faire creuser pour les instruments un trou jusqu'à la profondeur d'environ 20 pieds et d'y placer une vaisselle remplie de mercure. En regardant alors par la lunette dirigée sur le nadir, il y pouvait voir en même temps les images réfléchies d' $\alpha$  Cygni et de ses réseaux de fils, et après avoir appliqué encore un fil horizontal, mobile par une vis micrométrique, il pouvait déterminer la distance angulaire entre l'étoile et les fils fixes avec le plus haut degré d'exactitude.

A côté du cercle méridien il y a encore à Bologne un réfracteur de Steinheil de 6 pouces d'ouverture; mais comme le tube n'est pas encore monté convenablement, il n'y a pas moyen de l'employer avantageusement.

L'Observatoire de Modène est tout à fait insignifiant. Quoiqu'il se soit trouvé jusqu'à la dernière révolution politique sous la direction d'un savant distingué, M. Bianchi, on n'y a jamais exécuté des travaux qui aient laissé des traces dans la science. L'Observatoire est érigé sur le toit de l'ancien palais ducal. Au nombre des instruments il y a un bon cercle méridien de Reichenbach et Ertel, de la même construction et d'égales dimensions comme celui de Dorpat. A l'aide de cet instrument on pourrait sans doute faire encore quelques bonnes observations, à condition que son emplacement soit un peu plus solide et plus convenable. Nouvellement M. Ragona autrefois directeur de l'Observatoire de Palerme dans les dernières années du gouvernement des Bourbons, a été désigné directeur de celui de Modène.

A Turin l'observatoire se trouve en haut de l'ancien palais royal qui aujourd'hui est destiné aux réunions du Parlement Italien. Il y a beaucoup d'analogies, tant dans sa

construction que dans ses moyens instrumentaux, avec celui de Modène et est également insignifiant. L'illustre Directeur, le même Baron Plana, ne s'occupe que de la théorie des mouvements célestes et regarde même avec un certain dédain sur tout ce qui se fait en astronomie pratique. Il s'explique donc facilement que lui même il ne travaille pas à l'Observatoire et comme il n'a pas d'aide proprement dit pour ce but, tout l'établissement, à l'époque actuelle, est parfaitement inutile à la science.

Le dernier établissement visité par moi est celui de Padoue, où le vénérable M. Santini, maintenant un vieillard de 77 ans, travaille encore avec une ardeur de jeunesse, comme le prouvent entre autres le catalogues d'étoiles qu'il vient de publier. L'instrument principal y est un cercle méridien de Munich de 3 pieds de diamètre. En outre il y a, à côté d'une collection d'anciens instruments, un réfracteur de 6 pouces d'ouverture, monté par Starck de Vienne.

Dans sa construction, l'observatoire de Padoue est sujet aux mêmes défauts que les autres observatoires Italiens. Les instruments sont disposés en différents étages d'une ancienne tour de forme étrange, qui traditionnellement, au 13<sup>ème</sup> siècle, a servi de résidence au tyran Ezzelinus. Malheureusement je ne pouvais donner que deux heures à la visite de cet observatoire et à son illustre directeur, dont la conversation également bienveillante et animée a produit sur moi une impression profonde.

## Appendix 2. Draft of a letter from Struve to Donati, dated October 22, 1871<sup>87</sup>

Milan 1871 Oct. 22.

Très cher collègue!

Voici la carte photographique que Vous m'avez demandée. Elle a été faite à Rome et on me dit qu'elle est bonne.

A cette occasion permettez-moi de Vous répéter les expressions de ma gratitude sincère pour l'accueil amical que Vous m'avez fait à Florence. Malheureusement mon séjour n'a pu être que de courte durée. Mais ce qui était le plus important pur moi, je l'ai vu – votre nouvel Observatoire. Ayant eu l'honneur, il y a 8 ans, d'expliquer au Ministre de l'Instruction publique combien il était à désirer que les Observatoires astronomiques de l'Italie fussent sujets à une réforme fondamentale, qu'au lieu du grand nombre de ces établissements répandus sur le Royaume et dont presque aucun n'était pourvu de moyens suffisants aux exigences actuelles de la science, il serait utile de n'avoir qu'un petit nombre de bien organisés et convenablement dotés [sic], il a été pour moi l'objet d'une satisfaction particulière, qu'au moins pour Florence, mes vœux se trouvent en voie de réalisation. Quoique le nouvel Observatoire ne soit que de dimensions modiques qui prouvent que Vous avez bien su combiner les considérations d'une sage économie avec celles des exigences les plus urgentes de la science, je n'hésite pas de Vous exprimer toute ma confiance que Vous y aurez tous les moyens pour faire avancer la science avec un succès signalé. Le site de l'Observatoire est admirablement choisi et le plan général de l'édifice ne peut manquer d'obtenir l'approbation unanime des astronomes. Sous le beau climat de Florence, l'excellente lunette d'Amici, que Vous possédez déjà, Vous permettra de pénétrer dans tous les secrets de l'Univers. Ajoutez à cela un cercle méridien et les instruments d'astrophysique et d'optique, qui toujours ont formé [l'objet de Votre prédilection]<sup>88</sup>, et Vous serez pourvus de tout ce qu'il Vous faut, pour cueillir encore de nombreux lauriers sur la même voie que, grâce à Vos talents, vous avez déjà poursuivie avec tant de succès dans des conditions beaucoup moins favorables.

Mais hélas je Vous parle d'un avenir luisant, tandis que d'après ce que Vous m'avez raconté, la réalité en est encore très éloignée. Ce n'est pas à moi de juger les difficultés qui s'opposent encore à la réalisation complète de Vos projets. Mais au moins permettez moi de Vous exprimer ma conviction intime que Votre gouvernement éclairé ne laisse pas la belle oeuvre à moitié achevée, qu'il ne tardera pas d'applanir [sic] les difficultés en Vous fournissant sans délai tous les moyens pour satisfaire le plus tôt possible au désir général du monde astronomique et qui justifient parfaitement Vos plaintes que les meilleures années de votre vie soient perdues pour la science. La patrie de Galilée sans un Observatoire astronomique véritablement digne de ce nom, c'est de nos jours un anachronisme inexcusable!

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<sup>87</sup> Archive of the Russian Academy of Science, St. Petersburg branch, F. 286, Op. 1, D. 236, 19-20.

<sup>88</sup> This sentence is confused by deletions and repetitions.

Excusez mon cher collègue, les expectations auxquelles je me suis laissé entraîner par l'amour de notre science et pour les sentiments de sympathie cordiale que je Vous porte.

Croyez moi pour toujours

Votre très affectionné

O. Struve